

Astrophysics and Geophysics

A PIEZO TRANSDUCER FOR THE PICASSO DARK MATTER DETECTOR

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We have developed an interface circuit to couple piezo electric transducers to analog to digital converter cards in a personal computer, as the first step in studying acoustic properties of the PICASSO (<http://picasso.lps.umontreal.ca/>) Dark Matter detector. The goal of the collaboration is to acoustically observe liquid-to-gas phase transitions caused by the scattering of nuclei in superheated liquid droplets by galactic Weakly Interacting Massive Particles.

The detectors consist of a polymerized gel which suspends liquid droplets in a superheated state within a container that is acoustically coupled to piezo-electric sensors. The explosive phase transition causes an acoustic signal to emanate from the nucleation site. Among the many R&D problems for the experiment, it is necessary to learn acoustic properties of the detector, such as the attenuation length, speed of sound, ability to locate events in 3 dimensions, which sensors are ideal for the experiment, where they can be located, etc. IUSB is responsible for these studies. As a first step, we have designed a preamplifier which interfaces with piezoelectric crystals in an innovative way. Over the summer of 2003, we have been able to develop a general purpose, high bandwidth, constant gain amplifier which will be used to test a wide variety of sensors, make acoustic measurements, and possibly installed in the large scale PICASSO detector.

We will discuss the dark matter problem, the PICASSO experiment, the development and performance of the amplifier, and the future plans at IUSB.